

Measuring chemical pollutant gases in the port of Antwerp using imaging spectroscopy

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The Antwerp port is the home to the largest petrochemical complex in Europe and worldwide second only to Houston, Texas. Four oil refineries jointly occupy 175 ha of port area, offering a total refining capacity of close to 36 million tons and volume production of 16 million tones of chemicals per year. The development of the chemical products results in waste plume of different air pollutants to the urbane area closed by, and causes increase in respiratory illnesses to its population. The objective of this project is to detect the presence and the concentration of polluted gas compounds in the atmosphere using the AHS-160 airborne spectrometer over the chemical industry situated in the port of Antwerp.

In June 2005, AHS-160 flight campaign acquired VIS to LWIR data in two operational periods during the same day (morning and afternoon). The airborne data were calibrated and verified using numerous ground truth measurements that were collected using the field thermal imaging reflectometer (SOC 400T), AHS spectrometer and traditional *in-situ* measurements collected in AQMSs situated in the port.

Due to shut down of most of the refineries operational units in the flight period, the gas plume that has released to the atmosphere was thin, spotted and compounded mainly from SO₂. Different spectra match-filters were applied for the detection of the thin plume in the VNIR bands over homogeneous background as water and grass. Orthogonal background technique applied to the LWIR bands was used to separate the thermal radiance contrast of the plume over the heterorganic background of the industrial area. After the detection of the gas plume in the scene, Linear Unmixing technique was used to calculate how much the plume pixel mixed with pure SO₂. The unmixing clusters of each pixel help to produce a synoptical mapping of the SO₂ concentration along the plume from the outer of the chimney.